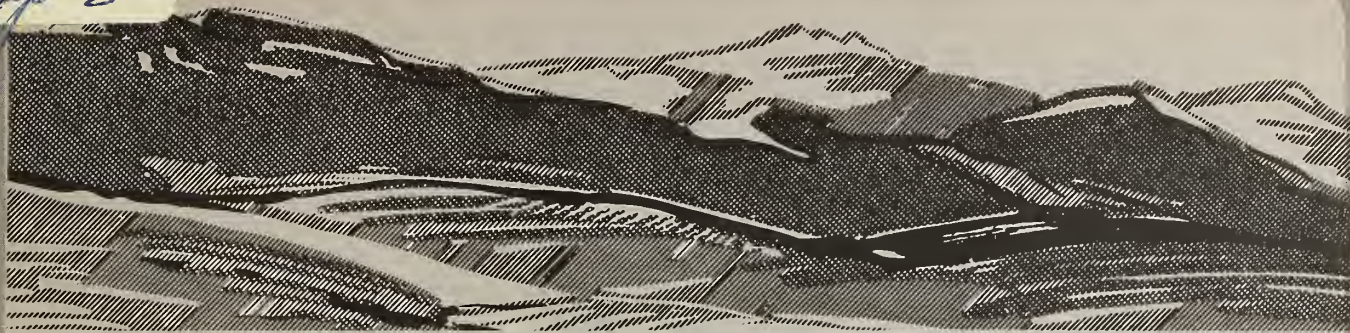


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RANGE IMPROVEMENT



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NOTES

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STATEMENT OF PURPOSE

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This publication is printed primarily to inform professional range administrators of important range improvement and management developments and findings. These "NOTES" may include extracts of published papers, unpublished preliminary reports of research work, unpublished reports on administrative studies and personal observations or suggestions of other range administrators. No claim is made as to the accuracy or completeness of studies or conclusions drawn.

All who read these RANGE IMPROVEMENT NOTES are encouraged to submit material for publication, or suggestions for improving its usefulness. Full credit will be given for any material used.

BUTYL RUBBER-LINED LIVESTOCK WATER RESERVOIRS

By
Lee Carr^{1/} and Pete Freeman^{2/}

Four (4) butyl rubber-lined livestock water reservoirs varying in capacity from 35,000 to 82,000 gallons have been constructed on the Pawnee National Grassland. This type of improvement is being employed to reduce the cost and increase the water storage capacity at windmill-powered water wells.

Windmills are dependable sources of power for lifting water - "when the wind blows." It is therefore necessary to have adequate water storage for periods when the wind does not blow

Range management on the Pawnee is directed toward more intensive management, employing various systems of deferred rotation. In pastures under rotation management large quantities of water are needed for short periods of time. Under the old system of management, continuous season-long grazing, four or five wells in a large pasture were adequate to "keep up" with the water demands of the livestock. When all the cattle are now placed in one-fourth (1/4) the area for 4 to 6 weeks, more total water is needed from one or possibly two wells in the subunit. The only answer for this increased water demand is to provide large water storage facilities that can be drawn from.

Butyl rubber membranes provide a cheaper storage reservoir as well as the advantage that water can be stored over winter without freezeup damage to the storage facility. A tabular comparison of costs follows:

	<u>Total Cost of Improvement</u>	<u>Cost-Gallon of Water Stored</u>
1. 10,000-gallon steel rim, concrete bottom storage and drinking tank. (This has been the "traditional" storage facility at windmills on the Pawnee N. G. as well as many other places.)	\$ 700	\$.070
2. 35,600-gallon butyl rubber membrane reservoir.	990	.028
3. 82,100-gallon butyl rubber membrane reservoir.	1520	.018

1/ District Ranger, Pawnee National Grassland, Greeley, Colorado - R-2

2/ Range Technician, Pawnee National Grassland, Roosevelt N. F.

Butyl rubber membranes offer advantages over vinyl membranes in that the membrane does not have to be covered with soil to eliminate ultra-violet deterioration. Common sense dictated the rubber membrane must be protected from trampling by livestock as well as sharp rocks within the reservoir. If the rubber membrane is punctured, however, it can be readily patched. Butyl rubber manufacturers claim the life expectancy of the membrane to be between 15 and 20 years. Since this material is new to us, we can only be conjectural in our life expectancy calculations. From our experience, even concrete-lined reservoirs generally do not exceed 20 years.

CONSTRUCTION TIPS

1. The 82,100-gallon reservoir was designed to be dug by a D-8 dozer, whereas the 35,600-gallon reservoir is designed for excavation with a backhoe. Using the backhoe for digging produces a very uniform hole, but is more expensive per cubic yard than a dozer. A D-4 dozer does a very good job more economically than a backhoe, but requires flatter slopes to work on. The D-8 dozer requires a wider pit, but does the most economical job of excavating. It is not as good for polishing up, however, as a D-4 dozer. A light farm tractor with blade is desirable for polish work and must be used where the backhoe does the primary digging to move the waste dirt out of the way. This small tractor with blade can also be used to smooth out irregularities in and around the pit. Very little waste dirt is available to build up the sides of the pit, as it is necessary to keep the fill wide enough that the tractor or dozer can work on; and unless the pit is dug on a nearly level spot, most of the waste dirt will be needed to fill the banks at the low spots. Some handwork will be necessary to smooth the sides so that no sharp material will puncture the butyl rubber sheets. Shovels and garden rakes are the best hand tools. From 1 to 10 man hours may be required for this work. Before laying the butyl rubber membrane the reservoir should be relatively smooth and free of sharp-angled rocks.
2. The trench for the outlet pipe is cut and backfilled with a backhoe after the reservoir is dug and before the rubber membrane is laid.
3. A valve control pit (3'x5' concrete tile) is located at the side of the reservoir. The pit eliminates a freezeup problem with reservoir outlet pipes, thus allowing water storage in the reservoir over the winter period.
4. Four sheets of 1/32"x20'x50' butyl rubber bonded together form the lining of the 82,100-gallon reservoir. Only two sheets of butyl rubber are needed for the 35,600-gallon reservoir. No seams are needed in the corners. The excess sheeting is allowed to fold over itself.

Splicing of butyl sheets is best done at temperatures of 50 to 70° F. If higher temperatures prevail, splicing should be done in a shed or other shaded area as the heat of the sun on the dark butyl sheeting is not conducive to good splices and the material becomes too hot to handle. These plans provide for 2 ft. of excess sheeting all around the pit to be buried under ground with about one foot of dirt to stabilize the sheeting.

5. Four or five men can easily install the butyl membrane, (50'x78') after bonding the four sheets together. By billowing air under the membrane it is easily dragged into the reservoir.
6. Before installing the membrane into the installation, a trench 12 to 18 inches deep should be dug around the outside of the excavation. After arranging the membrane the edges are laid in the trench and covered over.
7. Wells, powered by windmills, have been our major source of water. This type of storage could as well be used to store water from small springs, diversions from intermittent streams, or rain traps applying to catchment basins. The reservoir should be located on high ground so that gravity feed can be accomplished from the reservoir to the livestock drinking tank or tanks.
8. A livestock fence should be constructed around the reservoir to prevent puncture damage from livestock.
9. As a safety precaution, anchor a nylon rope on the outside and throw the end of the rope into the water. These "swimming holes" are very readily discovered by the local kids
10. An overflow pipe should be installed one foot below the top. One foot of freeboard is desirable one or two years after construction. As vegetation becomes established around the outside edge, this freeboard can be reduced 3 to 6 inches by increasing the length of the nipple on the overflow.
11. Technical advice on bonding the rubber membranes will usually be given by the rubber supplier.
12. The sides and waste material should be revegetated soon after completion of the reservoir. This will prevent washing as well as soil blowing into the reservoir.
- 13.. A special boot is available to seal any pipes running through the membrane.

<u>Bill of Materials for the 82,100-gallon reservoir</u>	<u>Cost</u>
4 sheets - 1/32"x20'x50' cured butyl rubber	\$ 1,000
200 ft. - 6"-wide raw butyl tape	18
300 ft. - 2-1/4" raw butyl tape	9
1 - 2" boot	5
1 - 1-1/4" boot	5
3 gallons - 88-99 adhesive	13
1 stitcher	5
1 - 3'x5' concrete tile	74
Excavation - D-8 Cat or comparable	125
Backhoe for digging outlet trench	75
Farm tractor for general levelling and smoothing area	20
Labor	
Splicing - 30 man hours	
Smoothing Excavation - 10 man hours	
Installing butyl membrane - 15 man hours	
Total 55 man hours @ \$2 per hour	110
Control Valves	
1 - 2" and 2 - 1-1/4" valves	25
Pipe - 42' of 2" pipe	32
Strainer for outlet	4
Total Cost	<u>\$1,520</u>

Bill of Materials for 35,600-gallon reservoir

2 sheets - 1/32"x20'x50' cured butyl rubber	\$ 500
100 ft. - 6"-wide raw butyl tape	9
100 ft. - 2-1/4"-wide raw butyl tape	3
1 - 2" boot	5
1 - 1-1/4" boot	5
1 gallon - 88-99 adhesive	5
1 stitcher	5
1 - 3'x5' concrete tile	74
Excavation with backhoe (including pipeout trench)	250
Farm tractor for smoothing	30
Labor	
Splicing - 6 man hours	
Smoothing slopes - 6 man hours	
Installing butyl membrane - 10 man hours	
Total - 22 man hours @ \$2 per hour	44
Control Valves	
1 - 2" valve and 2 - 1-1/4" valves	25
42' of 2" pipe	32
1 outlet strainer screen	4
Total Cost	<u>\$ 991</u>



82,100 Gallon Butyl Rubber-Lined Reservoir





Excavation as completed by dozer. Several hours hand shoveling and raking will smooth surface sufficient to lay rubber. At this point a backhoe is used to cut trench for outlet pipe.



3x5 foot Concrete Tile Outlet Valve Control Tile.





Outlet pipe and strainer in bottom of reservoir. Pipe came through boot which is bonded to rubber membrane.



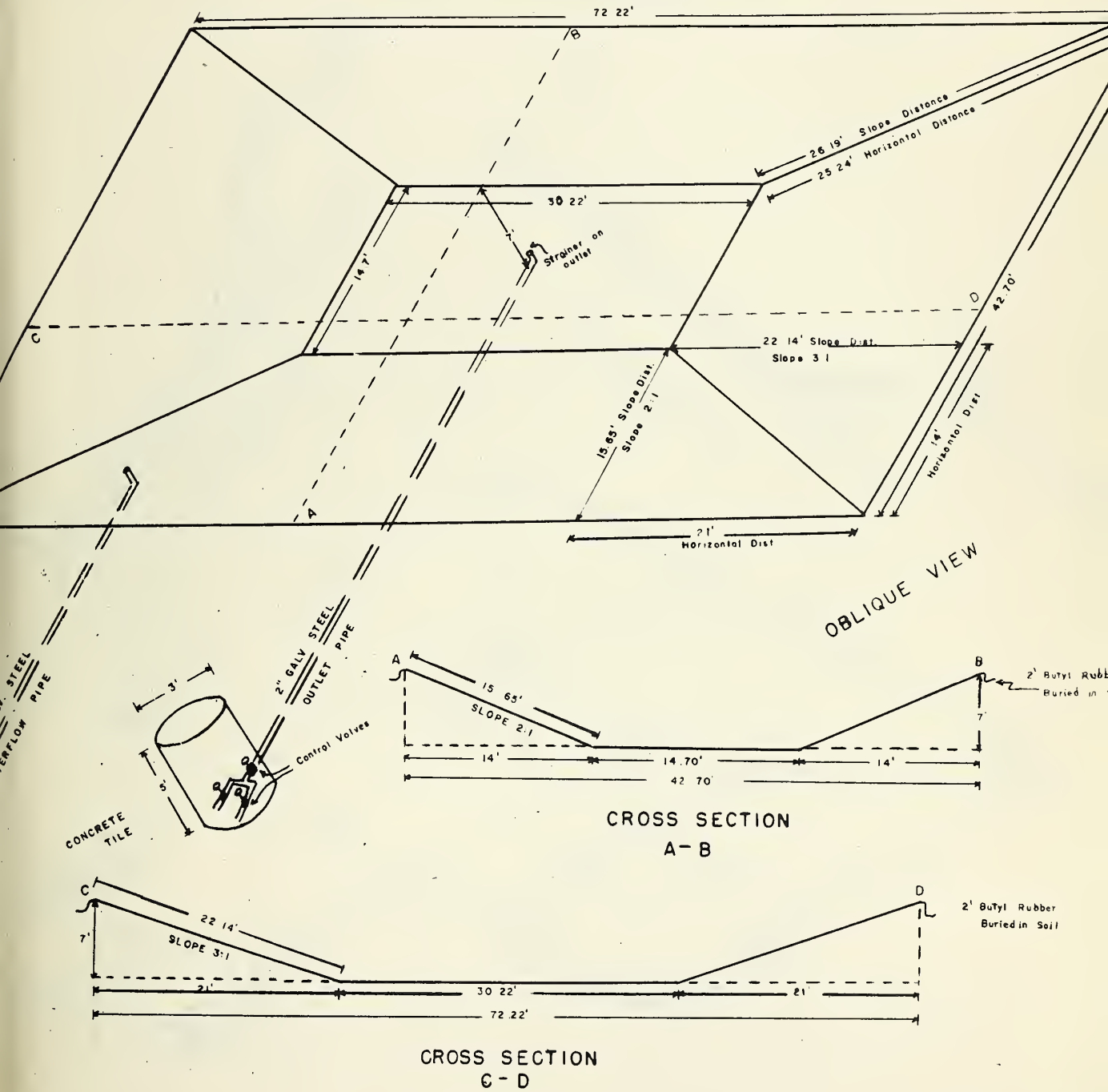
After seeding the sides with native grasses, burlap sheets are stapled to soil to eliminate sandy soil from blowing into reservoir.



BUTYL RUBBER LINED - LIVESTOCK WATER RESERVOIR

82,100 GALLON CAPACITY

PAWNEE NATIONAL GRASSLAND





SELECTIVE CHEATGRASS CONTROL WITH HERBICIDES

By
Robert L. Beschta^{1/}

Cheatgrass is an annual weedy grass that aggressively competes with desirable perennial grasses on nearly all rangelands in the Intermountain Region. Cheatgrass is often a major source of forage for range livestock, however, it is less desirable than perennial grasses because of its short green feed period, great variability in yield from year to year, and extremely high fire hazard.

Control of cheatgrass has not been undertaken on rangelands to an appreciable extent primarily because of lack of methods. In 1965, a pilot Fuel-Break^{2/} Project was initiated along the lower grass covered slopes of the Wasatch Front in Utah. One objective of this project is to determine the feasibility of selectively controlling cheatgrass (*Bromus tectorum*) in mixed stands of cheatgrass and perennial grasses. Control of cheatgrass by mechanical means often destroys any perennial grasses that are present, is usually costly, and, more often than not is ineffective. Herbicides appeared promising, and thus were utilized for this study. The herbicides used do not possess any known selectivity toward cheatgrass, but by using light rates and applying at the proper time of year it is hoped such selectivity could be obtained. For this study six herbicides (see Table I) were applied to a mixed stand of cheatgrass and perennial grasses (primarily sand dropseed, *Sporobolus cryptandrus*) near Farmington, Utah. All herbicides were applied during the fall of 1965. Control plots received no herbicide application. Vegetation measurements were conducted the following summer.

Table I. Rate of herbicide application

Herbicide	Rate of Application*	
	Rate #1	Rate # 2
Atrazine	1.5	3.0
Bromacil	2.0	4.0
Diuron	1.5	3.0
Fenac	5.0	10.0
Monuron	1.5	3.0
Simazine	1.5	3.0

*All rates are shown in lbs/acre, except Fenac, which is in gallons/acre.

^{1/}Forester, Intermountain Forest and Range Expt. Station, Ogden, Utah

^{2/}A "fuel break" is an area or strip of vegetation in which the fuel hazard has been reduced, as compared to a "firebreak" in which all vegetation has been removed.



Results

Bromacil was very effective in controlling cheatgrass (see Figure 1), however, this chemical also caused a 60 to 100 percent reduction in the cover of perennial grasses. Of the six herbicides tested, atrazine and simazine gave the most promising results. Atrazine, at both 1-1/2 and 3 lbs/acre, eliminated all cheatgrass without having any detrimental effect on the perennial grasses. In fact, the perennial grasses exhibited a dark green "fertilized" appearance during the spring and maintained this "fertilized" appearance well into the summer. They also showed increased vigor which was evident by their increased height and forage growth. At 3 lbs/acre simazine controlled all cheatgrass but did not obtain complete control at 1-1/2 lbs/acre. Perennial grasses on the simazine plots also had the dark green "fertilized" appearance and increased growth that had been observed on the atrazine plots.

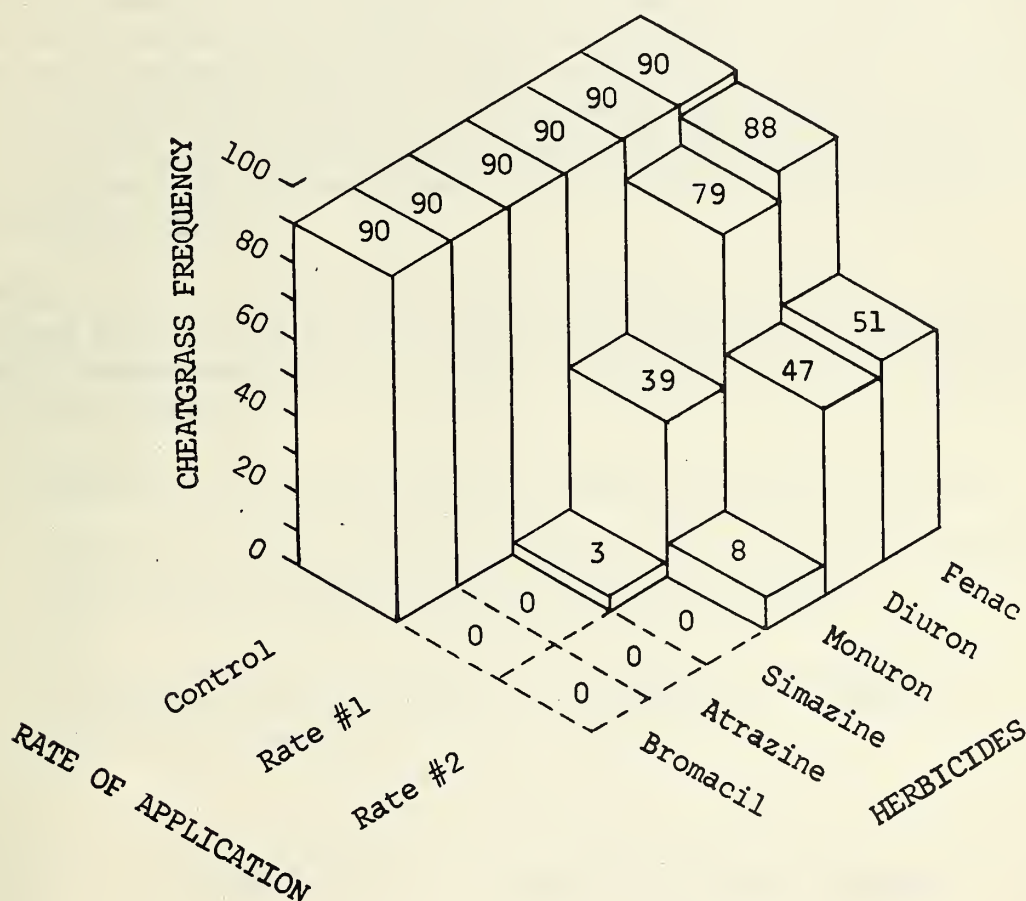


Figure I. Influence of herbicide and rate of application on cheatgrass (Bromus tectorum) frequency.

Monuron was moderately effective in controlling cheatgrass. At rates of 1-1/2 and 3 lbs/acre, it reduced the cheatgrass frequency by about 45 and 90 percent, respectively. Both fenac and diuron had little effect on cheatgrass at the lightest rates, but at higher rates a 45 to 50 percent reduction in cheatgrass frequency was accomplished.

Discussion

The above results indicate that certain herbicides (atrazine or simazine) can selectively control cheatgrass in mixed stands of cheatgrass and perennial grasses. Thus, for fire control purposes, extremely flashy fuels, i. e., cheatgrass, can be removed from an area without destroying the perennial grasses needed for watershed protection. The advantages of selectively removing cheatgrass are obvious; the fuel continuity is broken up, extremely flashy fuels are removed, and more moisture and nutrients will be available to perennial grasses so that they can stay green longer into the summer.

Although this study was primarily concerned with fuel hazard reduction, the use of these herbicides in rangeland improvement may also have merit. Visual observations on the study plots indicated that when cheatgrass competition was completely eliminated (by atrazine or simazine), a distinct increase in the forage production and height growth of perennial grasses was evident. Actual measurements were not made, but it was estimated that on some plots there was at least a two-fold increase in the forage production of perennial grasses.

The initial results of this study appear promising. However, more studies are needed before these herbicides can be successfully utilized in any fire control or range improvement projects. Questions still to be answered include the following:

1. How long will these herbicides remain effective in the soil?
- 2.. How will various soil types and the amount of annual precipitation modify the effectiveness of these herbicides.
3. Can one application of herbicide eliminate cheatgrass for a number of years, or will it be necessary to reapply the herbicide annually?

* * * * *

S A F E T Y . . . A good thing to keep in mind.

EXPERIMENTAL CROWN VETCH PLANTINGS

(Taken from a letter by A. Perry Plummer)

In Ephraim Canyon on the Manti-LaSal National Forest we have been observing experimental plantings of crownvetch (Coronilla varia) over a period of 4 years. The species occurs over a wide elevational range in the Mediterranean Basin. Our special concern has been its possible usefulness as a game forage. These are all small plot plantings involving 10 different sources. The site of the tests is at an elevation of 7,100 feet and located in an opening within the oakbrush zone where the average annual precipitation is about 16 inches. The soil on which the plantings occur is a fertile, clay loam which has been derived from limestone having a pronounced basic reaction.

Plantings were established by direct seeding as well as from seedling transplants grown in a greenhouse. Our direct seeding consisted of sparsely scattering the seeds in shallow furrows in April about as soon as it was possible to get on the ground; afterwards they were covered with about 1/2 inch of soil. The soil was firmed around the seeds by stepping along the rows. Bare-root seedlings were transplanted at the same time along rows from the greenhouse flats in which they had been planted about 2 months earlier.

Since this legume is not native, the nodule bacteria (Rhizobia), which lives symbiotically with the legume and manufactures nitrogen, is not in the ground. Consequently, it is important that the seed be inoculated with the specific nodule-forming bacteria. Cultures are usually available from the companies selling the seed. Directions for use usually accompany each culture and are easy to follow.

Overall performance from both direct seeding and transplants from these trials continues to be quite outstanding. A couple of sources showed some decline in stand after initial establishment, but we think this may have resulted more from the gopher activity than from lack of adaptation. We have found a wide variation in stature and productivity between the sources. However, all sources have shown exceptional ability to spread vegetatively on the sites where they occur, and all have matured good seed the past 3 years. The seed sources were obtained from the Regional Plant Introduction Station, Agricultural Research Service, at Pullman, Washington.

On the basis of the limited experimental results, we would have to say that this legume appears to be a promising one for a number of mountain sites at least similar to the one on which these experimental plots are located. We do suspect there is a considerable latitude of sites on which the species will grow. We intend to extend plantings onto other site conditions in the coming year.



I understand seed is quite generally available from a number of seed houses, especially in the East. This legume has been widely used in a number of eastern states for establishing cover on eroding slopes. On such sites, some type of protecting mulch is recommended when the seed is planted.

The species' propensity for retaining considerable green foliage through the winter indicates it has good possibilities for a winter, as well as a summer, forage for game. If it is suited for this purpose, it no doubt has other values and uses on mountain ranges.

I hope this much information may prove helpful. We would like to learn about any crownvetch plantings made by the Forests along with conclusions that develop as a result of followup observations. Certainly, it will take considerable testing to determine the ultimate place of this exotic legume in the West. From its limited performance in Ephraim Canyon, I feel confident that it does have a place as a forage and for controlling erosion on a number of sites on Forest ranges.

* * * * *

The man who FALLS DOWN
gets up a lot quicker
than
the one who LIES DOWN.

--Wyoming Stock Growers
October 15, 1966

* * * * *

If money grew on trees it might not be
such a problem getting someone to rake the leaves.

--Columbus, Ohio Dispatch

